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EVALUATION OF A WESTERN FALSE HEMLOCK LOOPER INFESTATION IN THE UPPER FLATHEAD VALLEY, MONTANA

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by

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A western false hemlock looper, *Neptyia freemani* Munroe, outbreak was detected in the late summer of 1973 at the north end of Flathead Lake. Defoliation, from barely detectable to heavy (most foliage removed from upper half of trees), occurred on Douglas-fir over about 3,000 acres located between Somers and Kalispell, Montana. Other patches of defoliation were conspicuous near Bigfork, Montana.

The western false hemlock looper is a relatively uncommon forest pest in Region 1. The only other time it has been reported at epidemic levels in the Region was in 1963 on the National Bison Range near Moiese, Montana. Defoliation during that outbreak was rated as moderate to heavy with from 25 to 85 percent of the needles gone (Tunnock 1964). The outbreak collapsed to natural causes by the fall of 1964.

Another outbreak reached epidemic levels in some Douglas-fir stands of British Columbia in 1972. Defoliation of up to 90 percent occurred on 3,200 acres (Ross, et al. 1973). In 1973 defoliation was apparent on 5,000 acres, with high larval counts found on many thousand additional acres. Top kill in the more severely defoliated stands was extensive and tree mortality occurred on about 300 acres. The 1974 egg mass survey indicates the outbreak will persist for at least another season with increased damage expected (Cottrell 1974).

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Life history.--Western false hemlock looper overwinters in the egg stage. Eggs are slightly oval, pale gray in color, and about 1.0 mm. across. They are laid on the needles, usually in clusters of three or four (fig. 1A), and hatch in mid-May. Young larvae feed on the newly developing needles, but when new growth is depleted old needles are fed upon also. Mature larvae are about an inch in length (fig. 1B). There are five larval instars (Klein and Minnoch 1971). Pupation occurs in late August. Pupae are about five-eighths of an inch in length and a pale green color with black and yellow markings on the outer wing coverings, antennae, and abdominal segments (fig. 1C). Male and female adults are quite similar in appearance. The wingspread is approximately 1-1/8 inches; they are pale gray with black wavy bands (fig. 1D). Moth flight lasts for about 1-1/2 months and is heaviest near mid-September.

METHODS

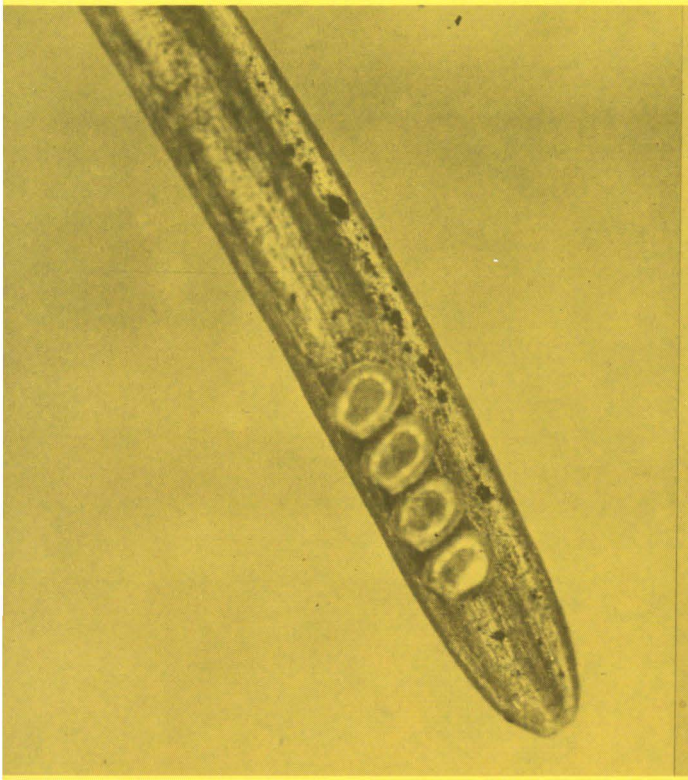
Areas of visible defoliation were visited in August to determine relative numbers of larvae and pupae and their general condition. An undetermined number of larvae and pupae were collected and placed in rearing containers for emergence of adult moths or parasites. Larvae showing disease symptoms were sent to Dr. Clarence Thompson, Insect Pathologist, Pacific Northwest Forest and Range Experiment Station, for diagnosis.

In mid-September the infestation was revisited to observe adult activity.

An egg mass survey was conducted in January. Samples were collected from four locations within the outbreak area (fig. 2). A sample consisted of one or two (depending on crown condition of the tree), approximately 24-inch Douglas-fir branches clipped from about 20 feet high from at least six trees per area. Branches were taken to the laboratory and examined for western false hemlock looper eggs. New (1973) eggs and old (1972) egg cases were counted. A sample of 100 eggs from each area was placed in Petri dishes and stored in rearing cabinets at about 75° F. and 40 percent relative humidity. When all emerging had ceased (about 14 days), larvae and egg parasites were counted. Each egg was then examined microscopically to determine which species of parasite had emerged from it; if a looper emerged from it; or if nothing had emerged from it. Characteristics in the emergence holes and appearance of the egg case made this distinction possible.

RESULTS AND DISCUSSION

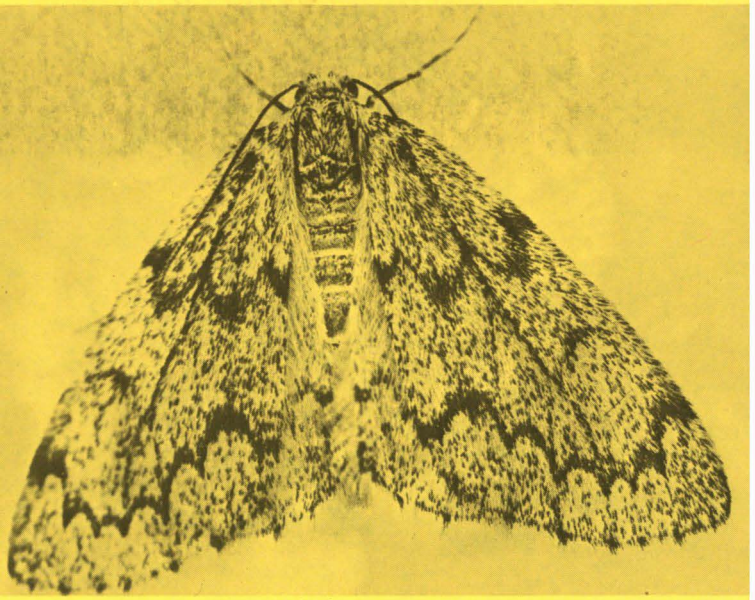
Larvae were very numerous at each area examined in mid-August. One tree was felled and it appeared that there were more loopers in the upper crown than in the lower portion of the tree, but no counts were made. By late August pupation was almost complete.



A. Eggs

B. Larva

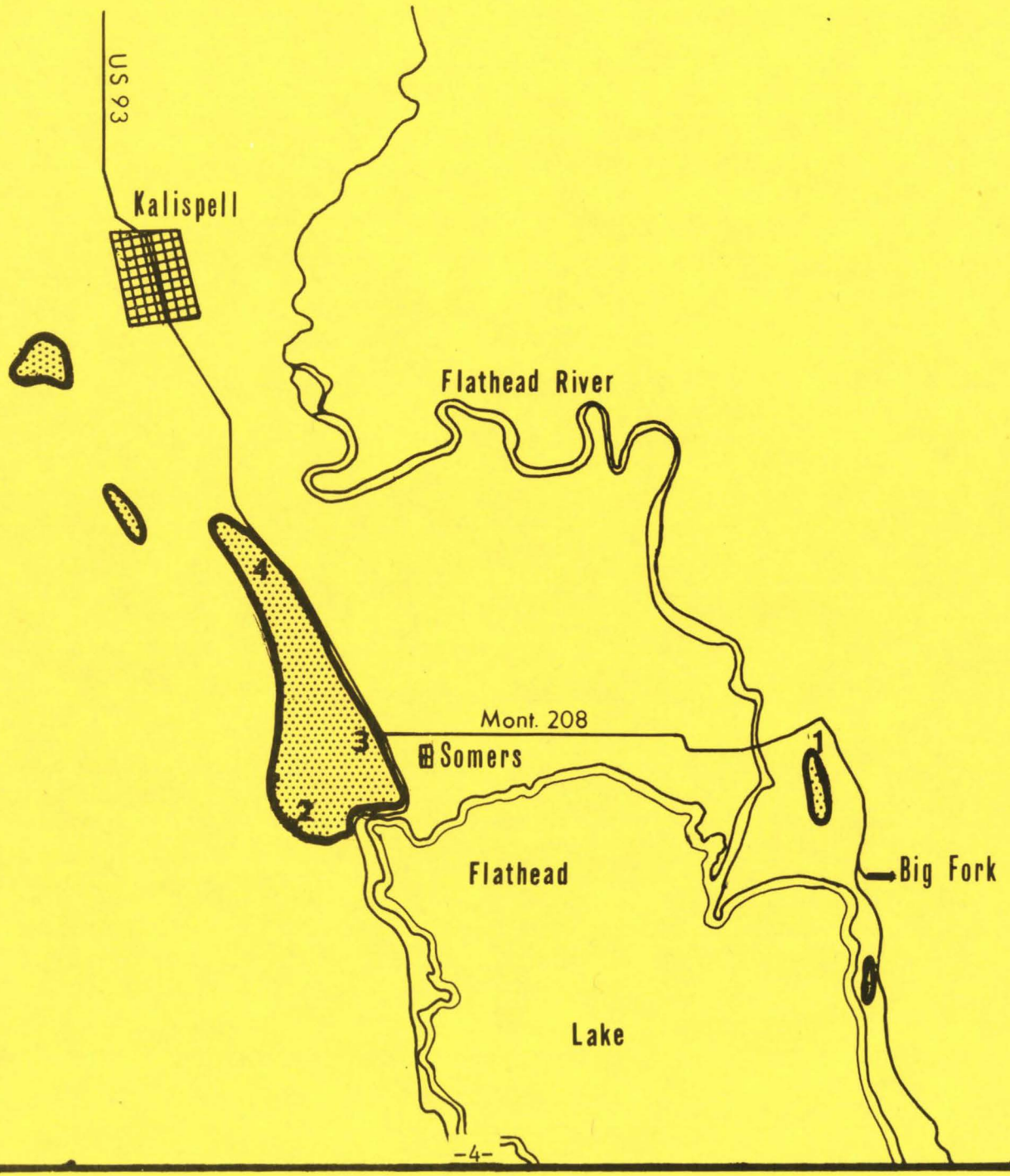
C. Pupa



D. Adult

Figure 1.--Life stages of western false hemlock looper.

Fig. 2
Western false hemlock looper defoliation areas and egg survey locations.



One of the more severely defoliated areas was re-examined during adult flight in mid-September. Large numbers of moths were observed resting on trees, brush, buildings, etc.

Larvae and pupae collected in August were laboratory reared for parasites. Exact parasitism levels were not determined but appeared low (less than 10 percent). Parasites recovered were a tachinid fly, *Ceromasia auricaudata* Tns., and two ichneumonid wasps, *Phobocampe* sp. and *Apechthis* sp. A small percentage of the larvae collected were infected with a nuclear polyhedrosis virus.

Results of the egg mass survey are shown in table 1.

Table 1.--Western false hemlock looper egg density data, Upper Flathead Valley, September 1973

Area	No. of branches collected	Total new eggs	Total old eggs	Ratio of new to old eggs	New eggs per sq. ft. foliage
1	12	278	16	17.4:1	20.7
2	17	749	75	10.0:1	35.4
3	18	507	81	6.3:1	26.9
4	29	3,190	848	3.8:1	72.7
Average	19	1,181	255	4.6:1	38.9

Two species of egg parasites, *Trichogramma minutum* Riley and *Telenomus* sp., emerged from collected eggs.[3/] Percent eggs from which parasites had emerged were 10 percent (Area 1); 11 percent (Area 2); 22 percent (Area 3); and 59 percent (Area 4). Looper larvae emerged from only about 3 percent of the eggs. This is blamed in part to less than optimum rearing conditions since fully developed larvae could be seen through the chorion of many unhatched eggs which probably would have hatched in nature. Many unhatched eggs were discolored and suspected to be parasitized. Egg dissections verified some parasites had died just prior to emergence. Because all unhatched eggs were not dissected, total egg parasitism was not determined. Egg parasitism is only known to exceed the aforementioned percentages.

Telenomus sp. developed one per egg; i.e., the number of parasites equaled the number of eggs with emergence holes. A total of 177 *Trichogramma minutum* emerged from 53 eggs for an average of 3.3 parasites per egg. These were found at Area 4 only.

Interpretation of the egg survey results is difficult because so little is known about the population dynamics of this insect. The only other false hemlock looper egg mass survey conducted in Region 1 used similar sampling techniques (Tunnock 1964). It revealed an average egg count of 40.3 per square foot of foliage; the range was 16 to 78 new eggs per square foot of foliage. These counts are quite comparable with the 1974 counts. The 40.3 eggs per square foot of foliage in 1964 resulted

3/ Identified by P. M. Marsh, U.S. National Museum, Beltsville, Md.

in a looper larval population sufficient to cause moderately severe defoliation in the summer of 1964 prior to the population collapse. Nothing is known about the level of egg parasitism in 1963-64. If populations are comparable in size during the two outbreaks, and other conditions are similar, it appears we can expect additional moderate to heavy defoliation in the infested area in 1974.

In British Columbia 25 new eggs per 18-inch branch are sufficient to result in moderate defoliation the following season, and 50 new eggs per 18-inch branch result in heavy defoliation (Cottrell 1974). Our egg counts would be equivalent to an average of 46.8 new eggs per 18-inch branch with a range among the plots of 18.2 to 75.2 new eggs per 18-inch branch.

We don't know how meaningful the new to old egg ratio is because we don't know what proportion of the hatched egg cases remain on the tree from one year to the next. If old cases do remain on the foliage for a year, then we can expect a tremendous increase in larval numbers in 1974 over 1973 since the average new egg to old egg case ratio was about 5:1.

From our egg mass survey, we predict moderate to heavy defoliation in 1974 with the possibility of some tree mortality occurring in the more severely defoliated areas. However, the effect of egg parasitism and other natural controls could reduce this damage significantly. If the current outbreak behaves similar to the 1963 National Bison Range infestation, it could die out due to natural causes during late summer of 1974. However, it could also persist and enlarge for 3 or more years as the present outbreak in British Columbia.

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